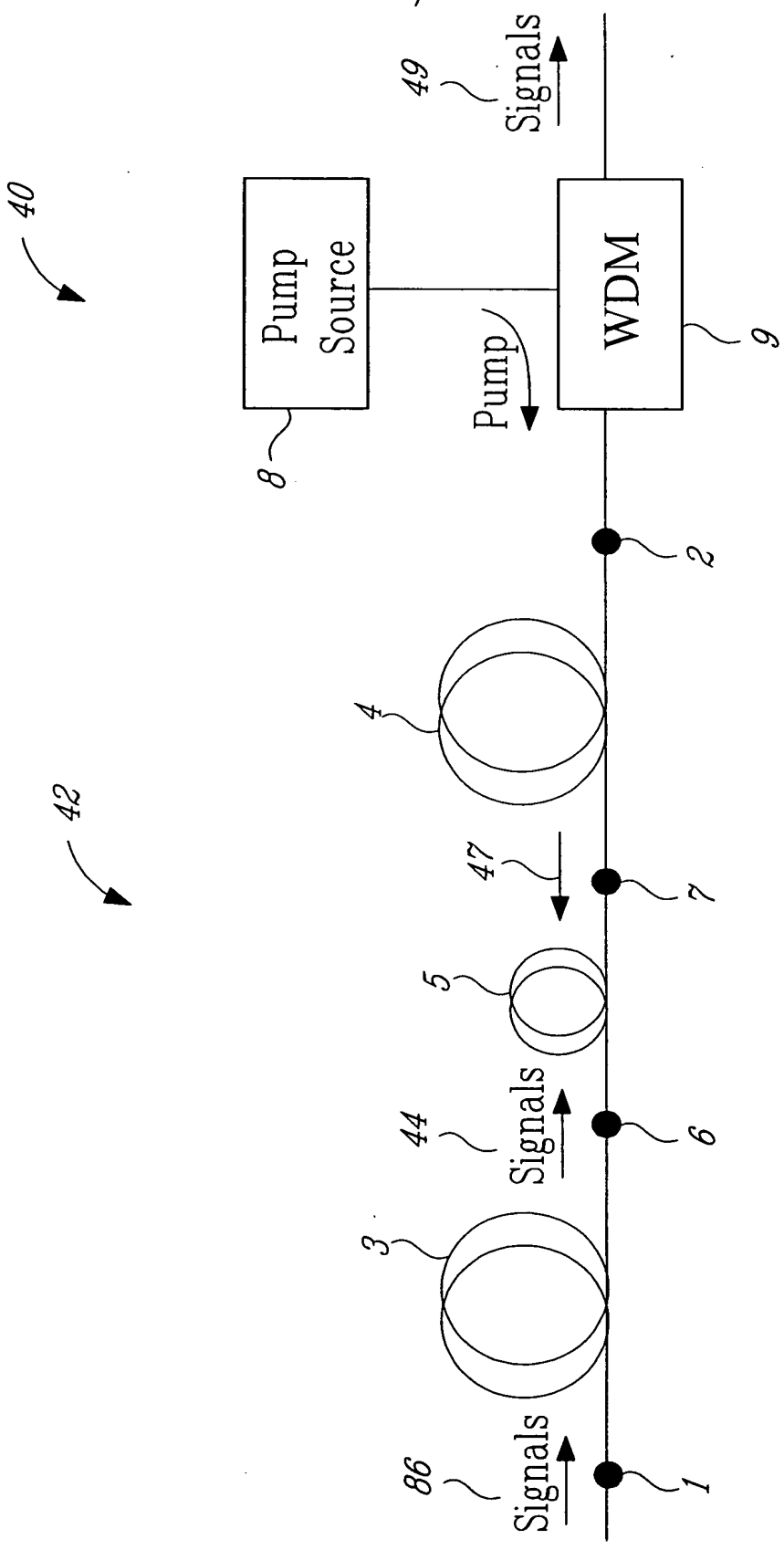
40
42
Pump Source
8
WDM
9
Pump
49
Signals
2
4
47
7
5
44
Signals
6
3
86
Signals
1

Fig. 1

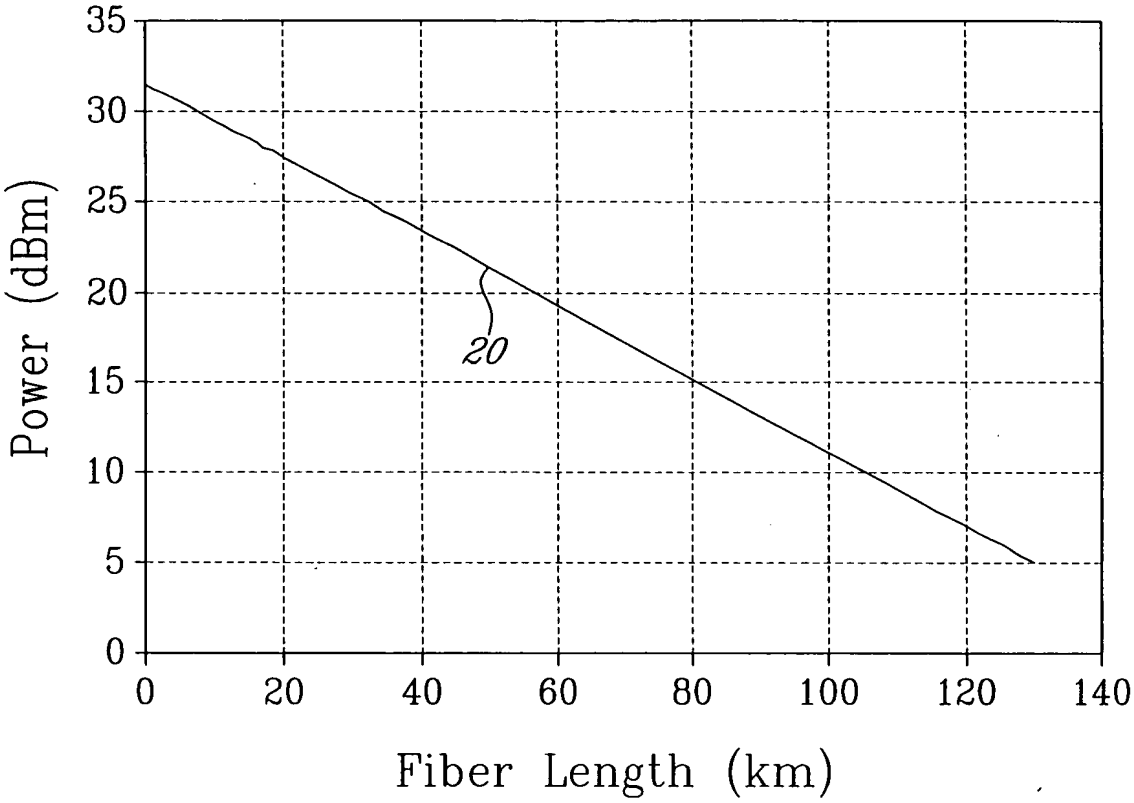
Power (dBm)
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
Fiber Length (km)
20

Fig. 2

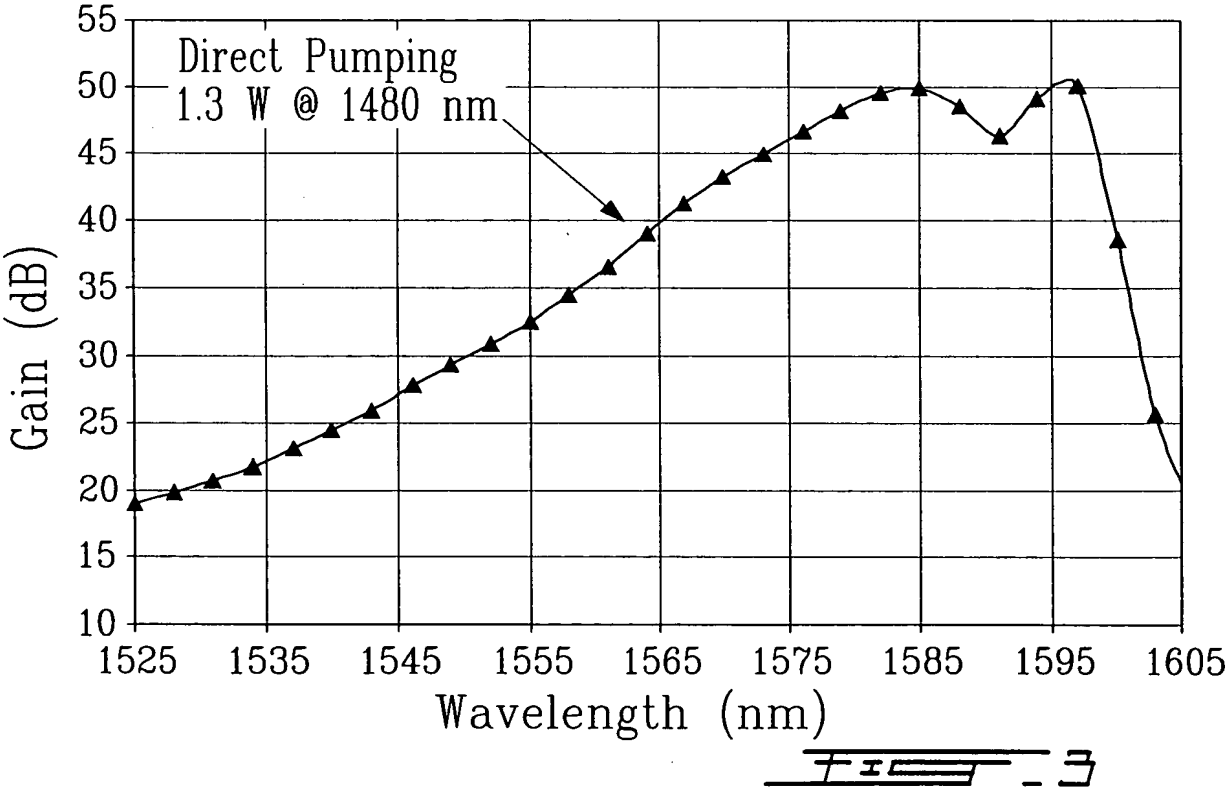
Direct Pumping
1.3 W @ 1480 nm
Gain (dB)
55
50
45
40
35
30
25
20
15
10
1525
1535
1545
1555
1565
1575
1585
1595
1605
Wavelength (nm)

Fig. 3

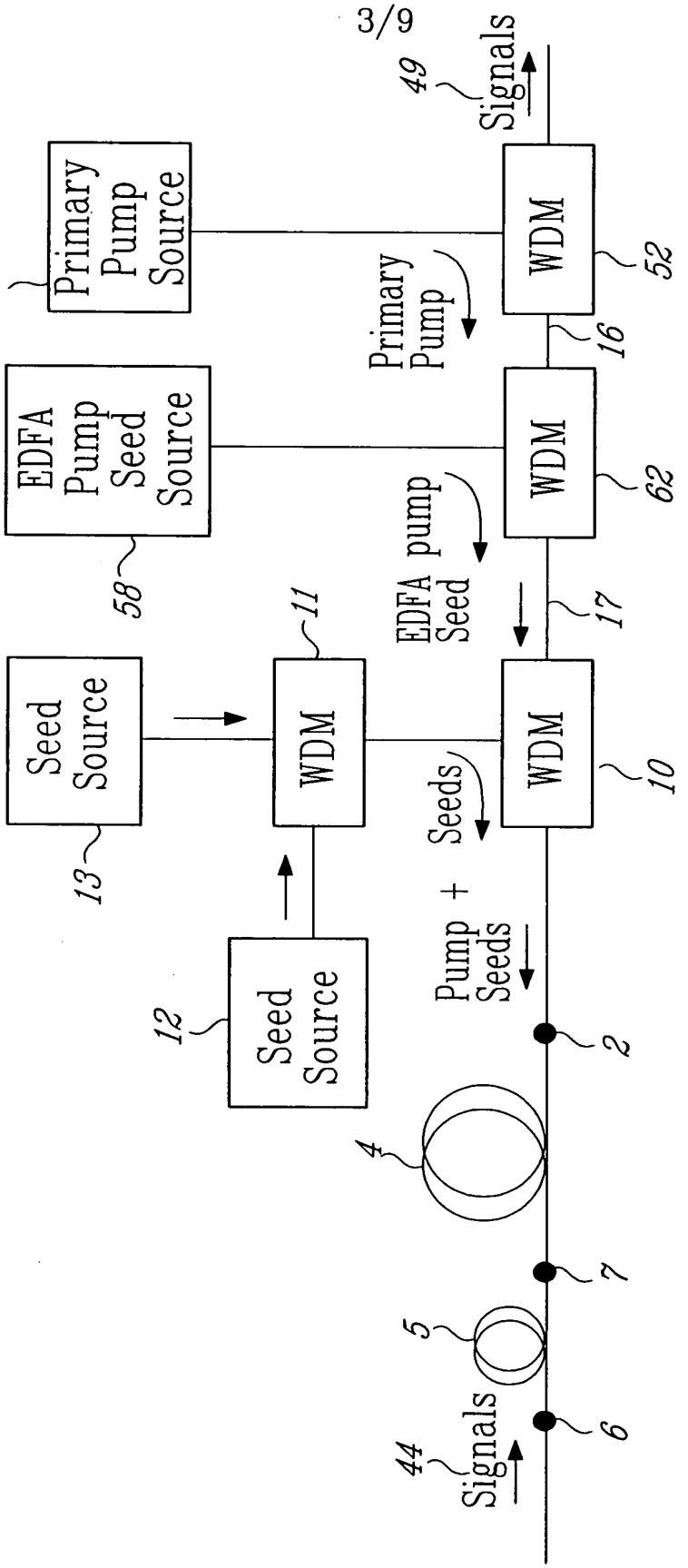
Signals
49
Primary Pump Source
50
WDM
52
Primary Pump
16
EDFA Pump Seed Source
58
WDM
62
EDFA pump
EDFA Seed
17
Seed Source
13
WDM
11
WDM
10
Seeds
Pump + Seeds
Seed Source
12
2
4
7
5
6
44
Signals

Fig. 4

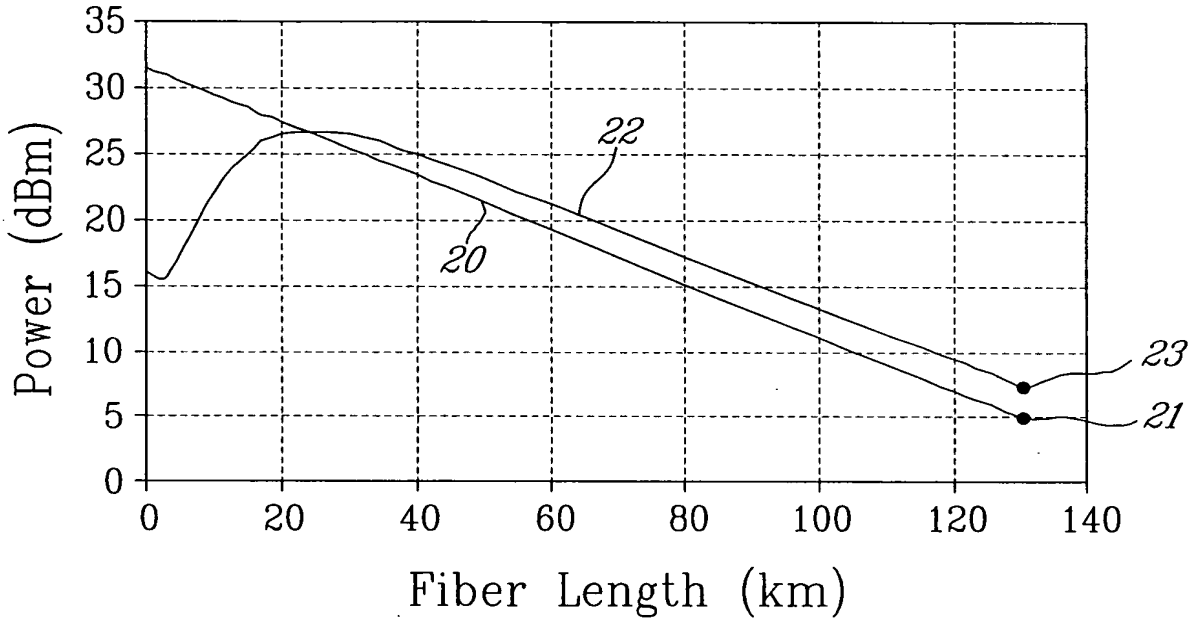
35
30
25
20
15
10
5
0
Power (dBm)
0
20
40
60
80
100
120
140
Fiber Length (km)
22
20
23
21

Fig. 5

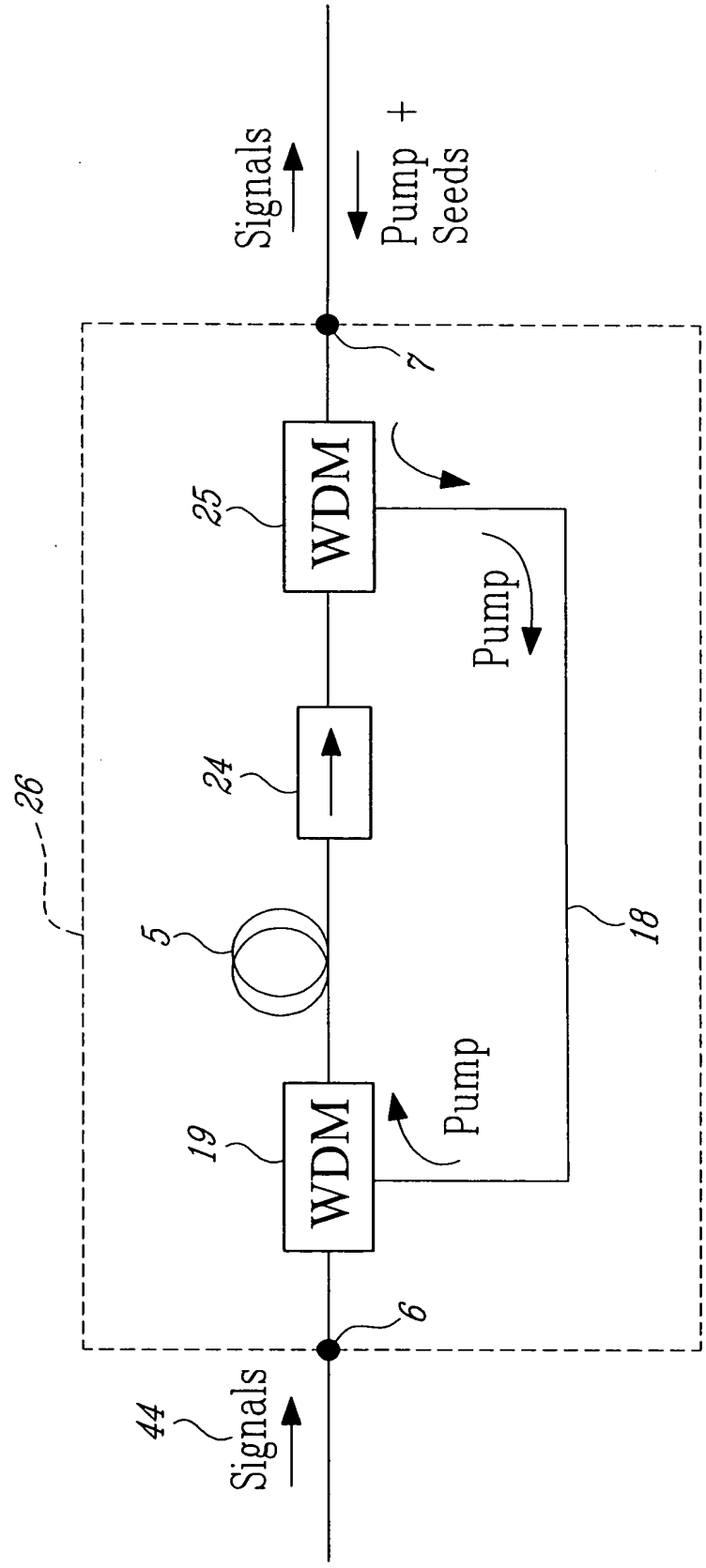
Signals
Pump + Seeds
7
25
WDM
Pump
24
26
5
18
19
WDM
Pump
6
44
Signals

Fig - 6

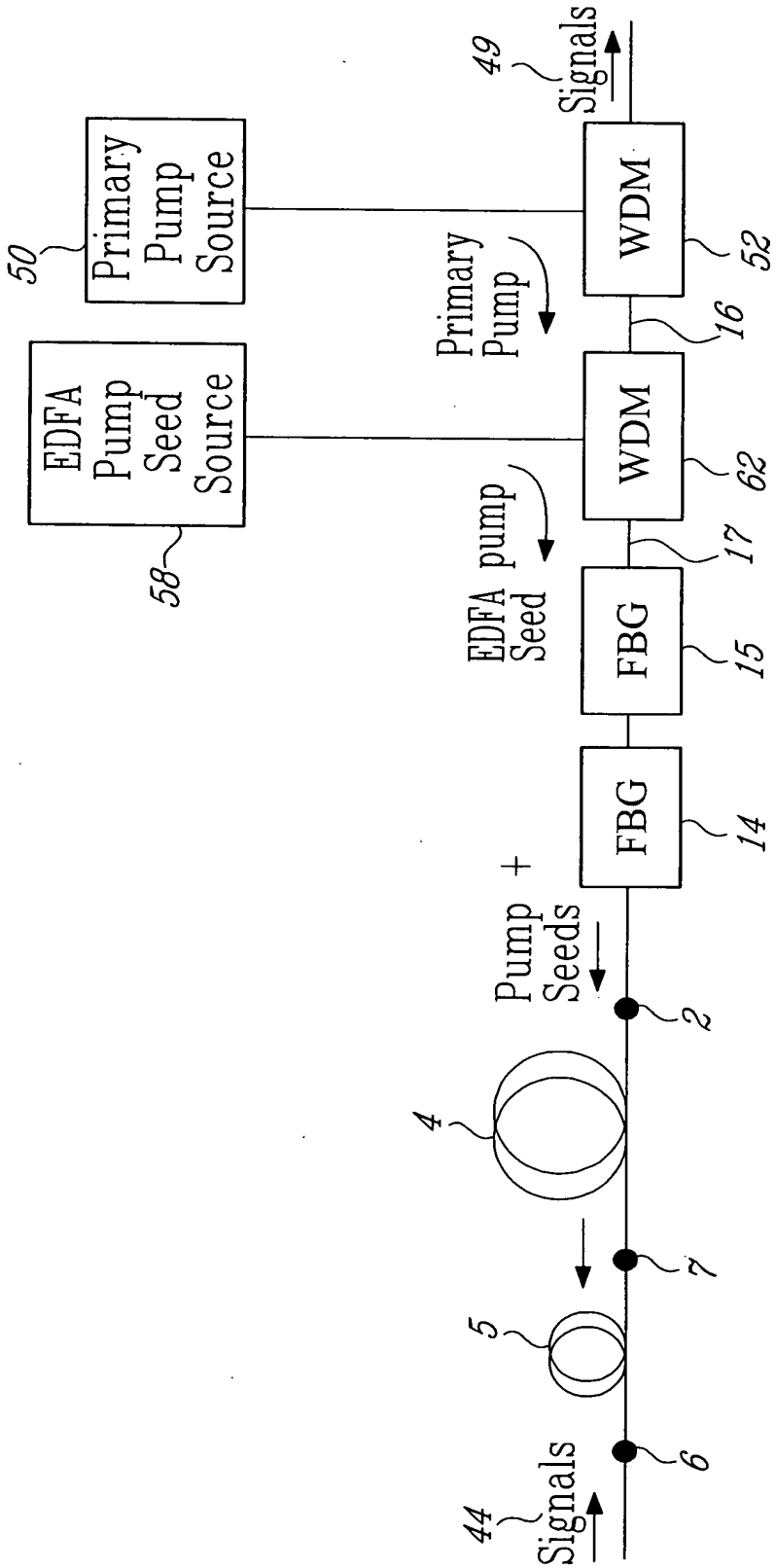
Signals
49
Primary Pump Source
50
WDM
52
Primary Pump
16
EDFA Pump Seed Source
58
WDM
62
EDFA pump Seed
17
FBG
15
FBG
14
Pump + Seeds
2
4
7
5
6
Signals
44

Fig. 7

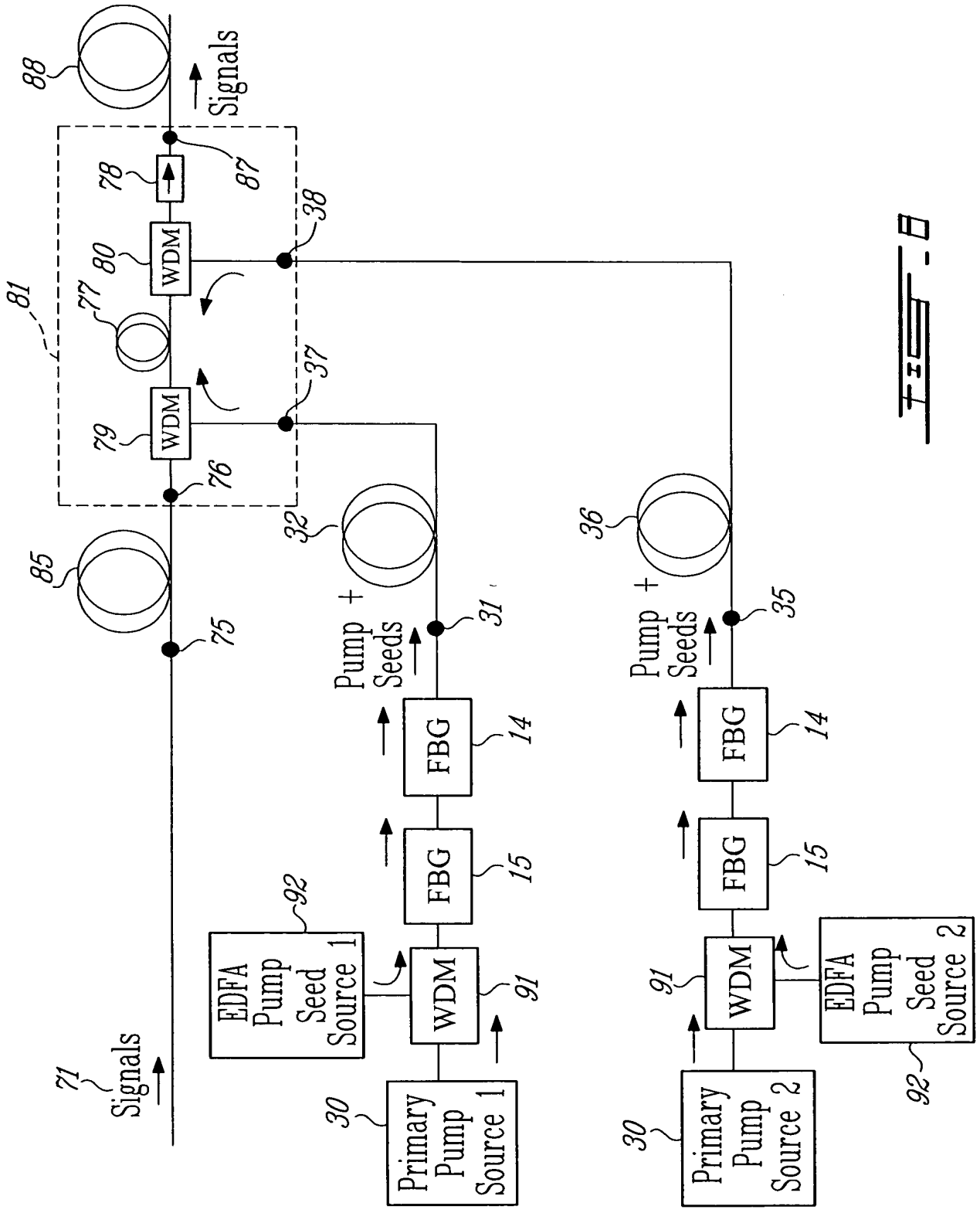
Signals
71
Signals
88
87
78
WDM
80
77
81
WDM
79
76
85
75
38
37
32
36
Pump + Seeds
31
Pump + Seeds
35
FBG
14
FBG
15
EDFA Pump Seed Source 1
92
WDM
91
Primary Pump Source 1
30
FBG
14
FBG
15
91
WDM
EDFA Pump Seed Source 2
92
Primary Pump Source 2
30

Fig - 8

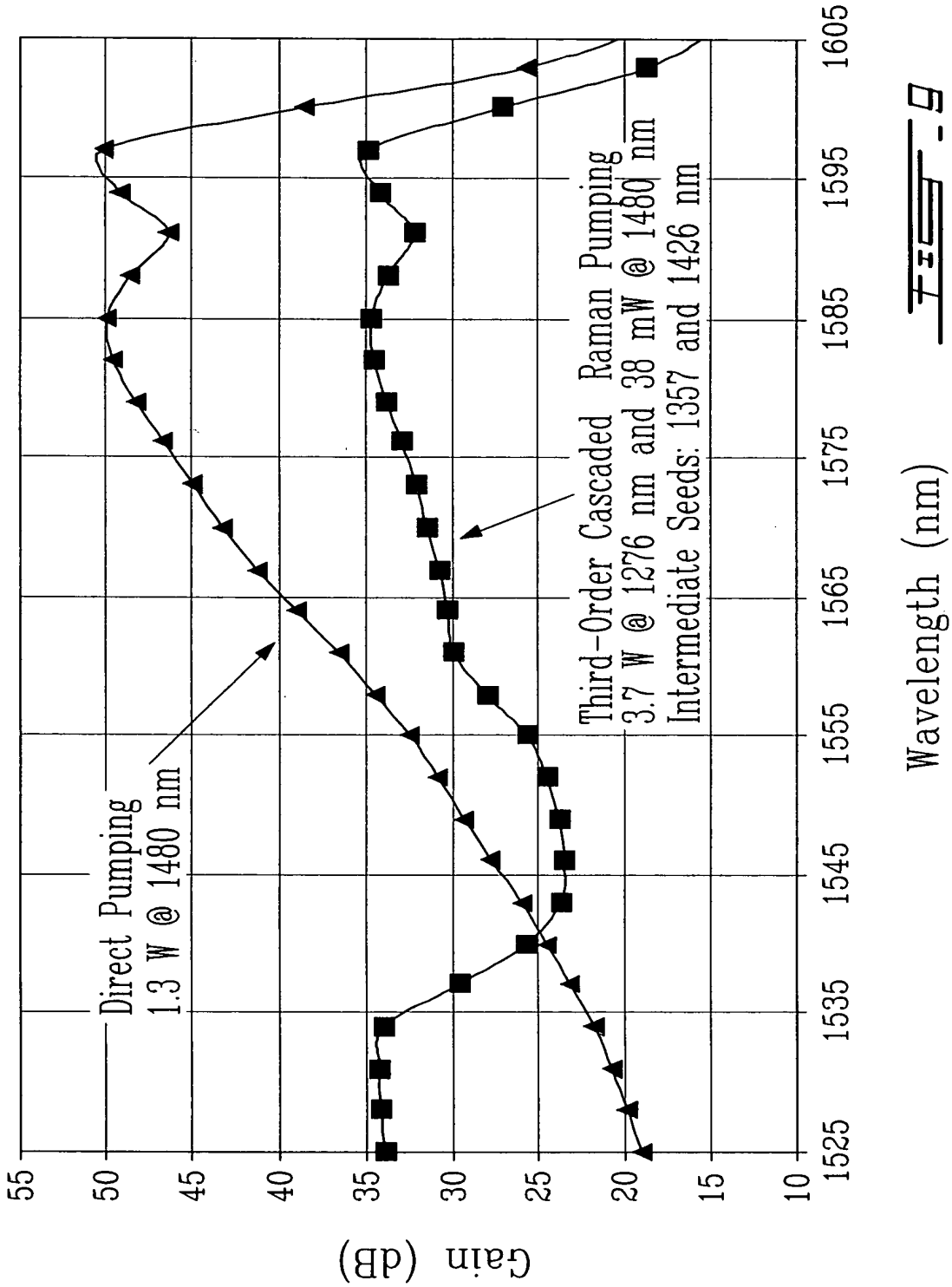
Gain (dB)
55
50
45
40
35
30
25
20
15
10
1525
1535
1545
1555
1565
1575
1585
1595
1605
Wavelength (nm)
Direct Pumping
1.3 W @ 1480 nm
Third-Order Cascaded Raman Pumping
3.7 W @ 1276 nm and 38 mW @ 1480 nm
Intermediate Seeds: 1357 and 1426 nm

Fig. 9

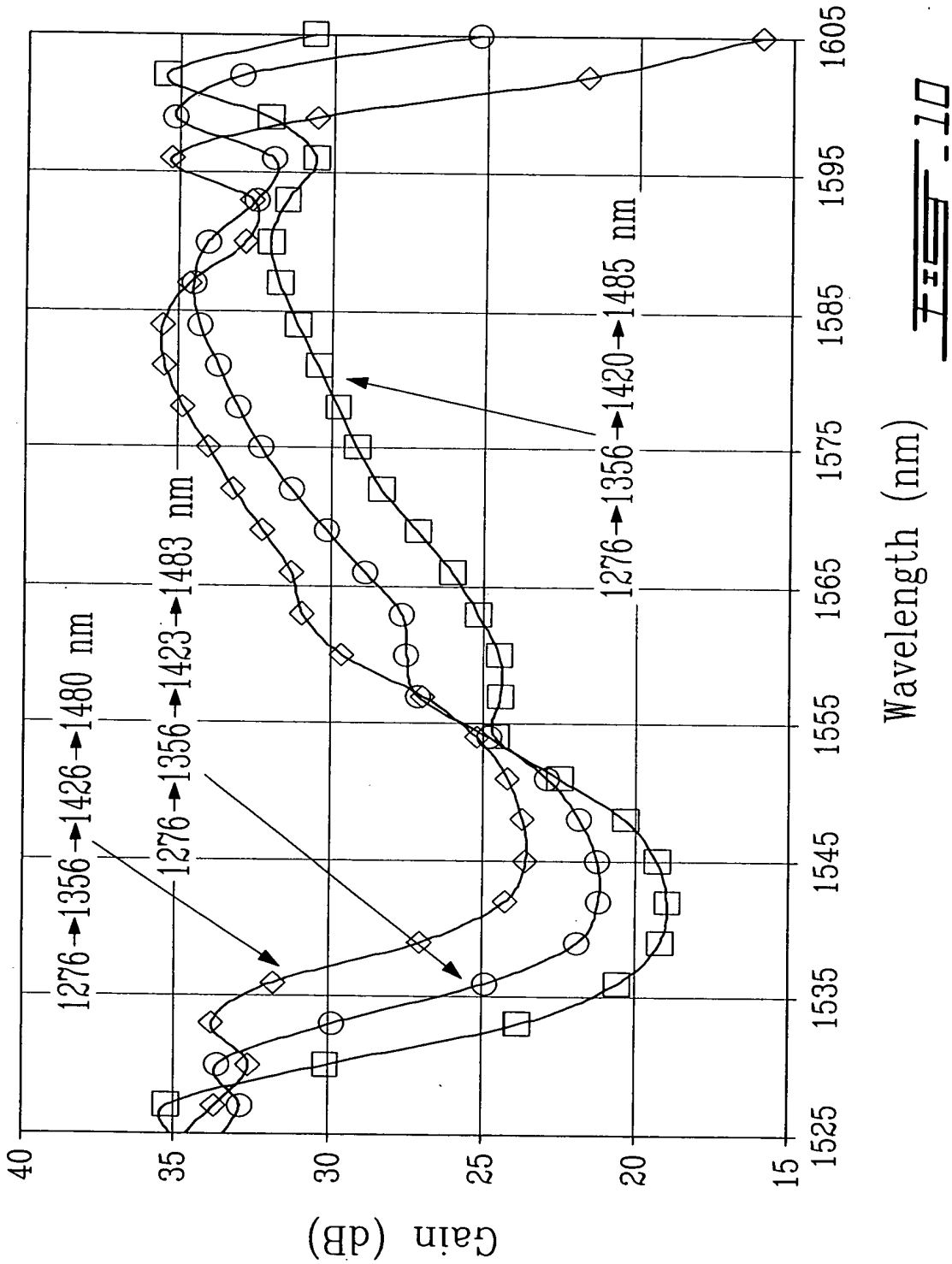
Gain (dB)
40
35
30
25
20
15
1525
1535
1545
1555
1565
1575
1585
1595
1605
Wavelength (nm)
1276→1356→1426→1480 nm
1276→1356→1423→1483 nm
1276→1356→1420→1485 nm

Fig. 10